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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7351750366

BIOLOGY **9700/33**

Paper 3 Advanced Practical Skills 1 **February/March 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do **not** use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
Total	

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Before you proceed, read carefully through the **whole** of Question 1 and Question 2.

Plan the use of the **two hours** to make sure that you finish all the work that you would like to do.

If you have enough time, think about how you can improve the confidence in your results, for example by obtaining and recording one or more additional measurements.

You will **gain marks** for recording your results according to the instructions.

1 Mung bean seeds contain an enzyme that is used to hydrolyse (break down) sucrose into reducing sugars. This enzyme is essential to provide the reducing sugars needed for the seeds to grow.

When mung bean seeds are soaked in sucrose solution, some of this enzyme diffuses into the surrounding solution and hydrolyses the sucrose.

$$\text{sucrose} \xrightarrow{\text{enzyme from seeds}} \text{glucose and fructose}$$

The apparatus was set up as shown in Fig. 1.1.

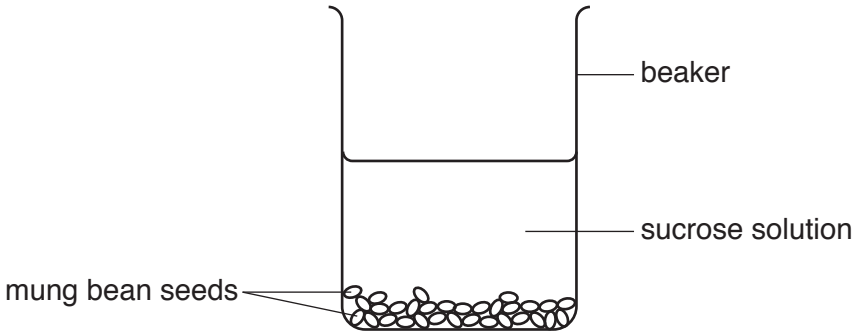


Fig. 1.1

Samples of the sucrose solution were removed at 10 minutes (sample **S1**), at 15 minutes (sample **S2**) and at 30 minutes (sample **S3**) after adding the sucrose solution.

You are required to:

- make a serial dilution of 1.0% reducing sugar solution, **R**
- carry out the Benedict's test on each concentration of reducing sugar
- carry out the Benedict's test on **S1**, **S2** and **S3**
- estimate the concentration of reducing sugar in **S1**, **S2** and **S3**.

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You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume/cm^3
R	1.0% reducing sugar solution	none	50
S1	sample removed after 10 minutes	none	20
S2	sample removed after 15 minutes	none	20
S3	sample removed after 30 minutes	none	20
W	distilled water	none	100
Benedict's	Benedict's solution	harmful	40

It is recommended that you wear suitable eye protection. If **Benedict's** comes into contact with your skin, wash it off immediately under cold water.

1. Set up a water-bath and heat the water to a suitable temperature to test for reducing sugars using the Benedict's test.

(a) (i) State the temperature you will need to maintain in the water-bath to carry out the Benedict's test.

temperature .....[1]

You are required to make a **serial** dilution of the 1.0% reducing sugar solution, **R**, which reduces the concentration **by half** between each successive dilution. This will provide you with a set of reducing sugar solutions of known concentrations.

After the serial dilution is completed, you will need to have 10 cm^3 of each concentration available for use.

Fig. 1.2 shows the first two beakers that you will use to make your serial dilution.

(ii) Complete Fig. 1.2 by drawing as many extra beakers and arrows as you need to show how you will carry out your serial dilution.

For each beaker:

- state, under the beaker, the **volume** and **concentration** of the reducing sugar solution in the beaker that will be available for use in the investigation, after the serial dilution has been completed
- use one arrow, with a label above the beaker, to show the **volume** and **concentration** of reducing sugar solution added to prepare the concentration of the reducing sugar solution in the beaker
- use another arrow, with a label above the beaker, to show the **volume** of distilled water, **W**, added to prepare the concentration of reducing sugar solution in the beaker.

The first part of Fig. 1.2 has been labelled for you.

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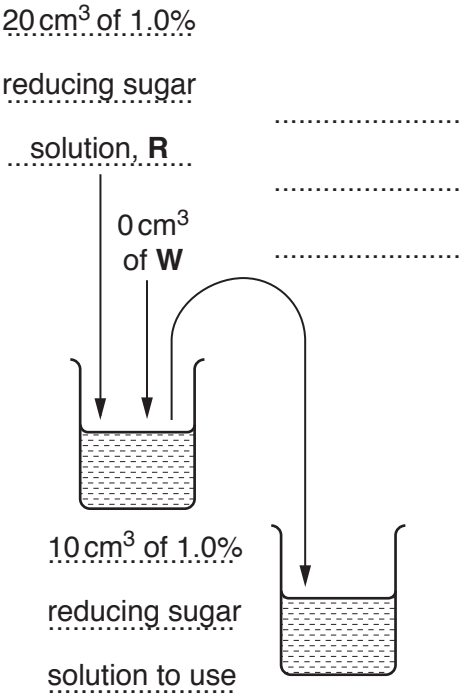


Fig. 1.2

[3]

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Read step 2 to step 4 before proceeding.

2. Prepare all the concentrations of reducing sugar solution shown in Fig. 1.2, in the beakers provided.

(iii) You will need to carry out a Benedict's test on each of the different concentrations of reducing sugar solution and on 2 cm^3 of each of **S1**, **S2** and **S3**.

You will be recording the time taken for the first appearance of a colour change.

State the volume of Benedict's solution and the volume of each of the concentrations of reducing sugar solution you will use for each test.

volume of Benedict's solution .....

volume of each concentration of reducing sugar solution .....

[1]

3. Using the volumes you decided in **(a)(iii)**, carry out the Benedict's test on the reducing sugar solutions of different concentrations shown in Fig. 1.2.

Test one solution at a time, using the syringe labelled **B** for the Benedict's solution.

Record, in **(a)(iv)**, the time taken for the first appearance of a colour change.

If there is no colour change after 120 seconds, record as 'more than 120'.

(iv) Record your results in an appropriate table.

[4]

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You are required to estimate the concentration of reducing sugars in **S1**, **S2** and **S3**.

4. Carry out the Benedict's test on 2 cm^3 of each of **S1**, **S2** and **S3** and record the time taken for the appearance of the first colour change.

(v) State the time taken for the appearance of the first colour change for **S1**, **S2** and **S3**.

S1 ..... **S2** ..... **S3** ..... [1]

(vi) Complete Fig. 1.3 by:

- labelling the position on the line of each of the percentage concentrations of reducing sugar solution shown in Fig. 1.2
- putting the labels **S1**, **S2** and **S3** on Fig. 1.3 to show an estimate of the concentrations of reducing sugar in **S1**, **S2** and **S3**.

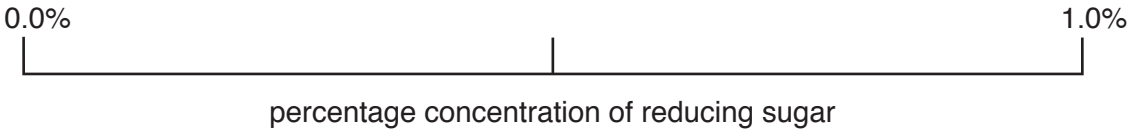


Fig. 1.3

[2]

(vii) Sample **S1** was removed from the sucrose solution 10 minutes after seeds had been added. Sample **S2** was removed 15 minutes after the seeds had been added.

Suggest an explanation for the difference in results for **S1** and **S2**.

.....

.....[1]

(viii) If the mung bean seeds are soaked in the sucrose solution for more than 30 minutes, the concentration of reducing sugar remains the same as **S3**.

Use your knowledge of enzymes to explain this observation.

.....

.....[1]

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(b) A student set up the apparatus shown in Fig. 1.4 to investigate whether a different type of seed also releases an enzyme that hydrolyses sucrose.

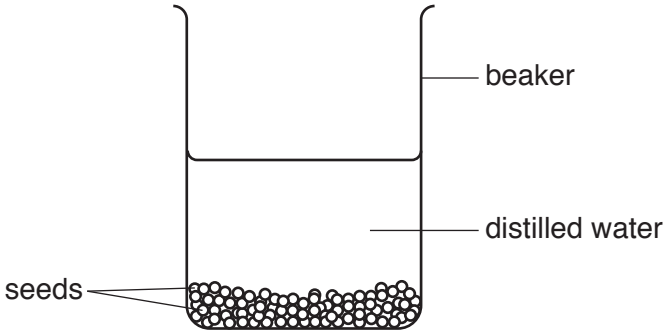


Fig. 1.4

After 30 minutes, the student tested the water for protein. This test showed that protein was present in the water.

(i) State the name of the test for protein.

.....[1]

The student suggested the hypothesis:

the protein in the water is an enzyme that hydrolyses sucrose.

(ii) The student mixed 2 cm^3 of the water containing the protein with 5 cm^3 of 1% sucrose solution. After 30 minutes, reducing sugars were present.

Describe how the student could have set up a suitable control for this experiment to provide evidence that hydrolysis of sucrose was due to an enzyme.

.....

.....

.....

.....

.....[2]

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Another student tested the concentration of this enzyme that had been released from the seeds of several different species using a standard method.

The results are shown in Table 1.2.

Table 1.2

species of plant	concentration of enzyme /arbitrary units
F	9.5
G	15.0
H	17.0
J	20.5
K	39.5

(c) Draw a bar chart of the data in Table 1.2 on the grid in Fig. 1.5.

Each bar should be separated for each species of plant.

Use a sharp pencil for drawing bar charts.

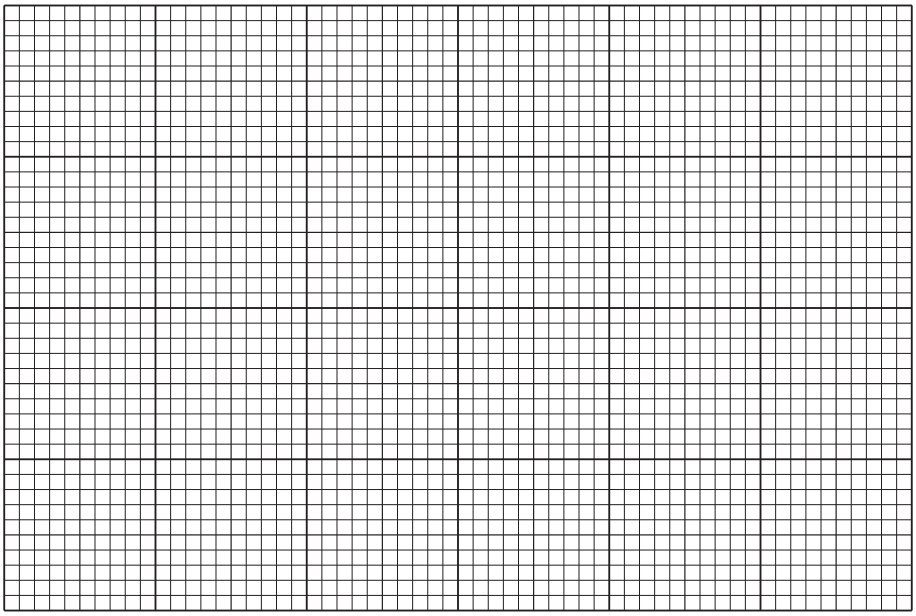


Fig. 1.5

[4]

[Total: 21]

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2 (a) **P1** is a slide of a stained transverse section through a plant leaf.

You are not expected to be familiar with this specimen.

You are required to:

- use the eyepiece graticule to measure the depth of the leaf and the depth of a vascular bundle at the mid-rib
- use these measurements to draw a plan diagram of part of the leaf.

The eyepiece graticule in the microscope can be used to measure different tissues.

Select the widest part of the leaf (mid-rib) on **P1**, shown by **Y** in Fig. 2.1.

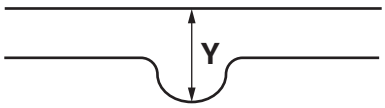


Fig. 2.1

(i) Use the eyepiece graticule in the microscope to measure:

- the depth of the leaf at the mid-rib
- the depth of the vascular bundle at the mid-rib.

depth of leaf ..... eyepiece graticule units

depth of vascular bundle ..... eyepiece graticule units
[1]

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Use a sharp pencil for drawings.

(ii) Use the measurements from **(a)(i)** to help you to draw a large plan diagram of the section of the leaf shown by the shaded area in Fig. 2.2.

Use **one** ruled label line and label to identify the vascular bundle.

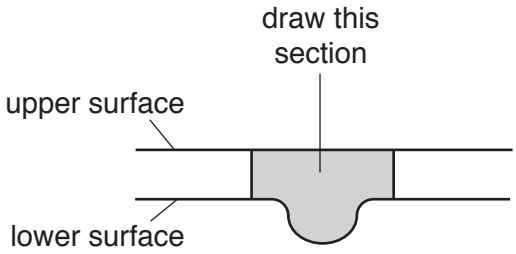


Fig. 2.2

You are expected to draw the correct shape and proportions of the different tissues.

[5]

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Question 2 continues on page 13

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(iii) Observe the upper epidermis of the leaf and the layer of cells below the upper epidermis. Fig. 2.2 identifies the upper and lower surfaces of the leaf.

Select three epidermal cells and one cell in the layer below that touches these cells.

Make a large drawing of this group of four cells. Each cell must touch at least one of the other cells. Do **not** draw the cuticle.

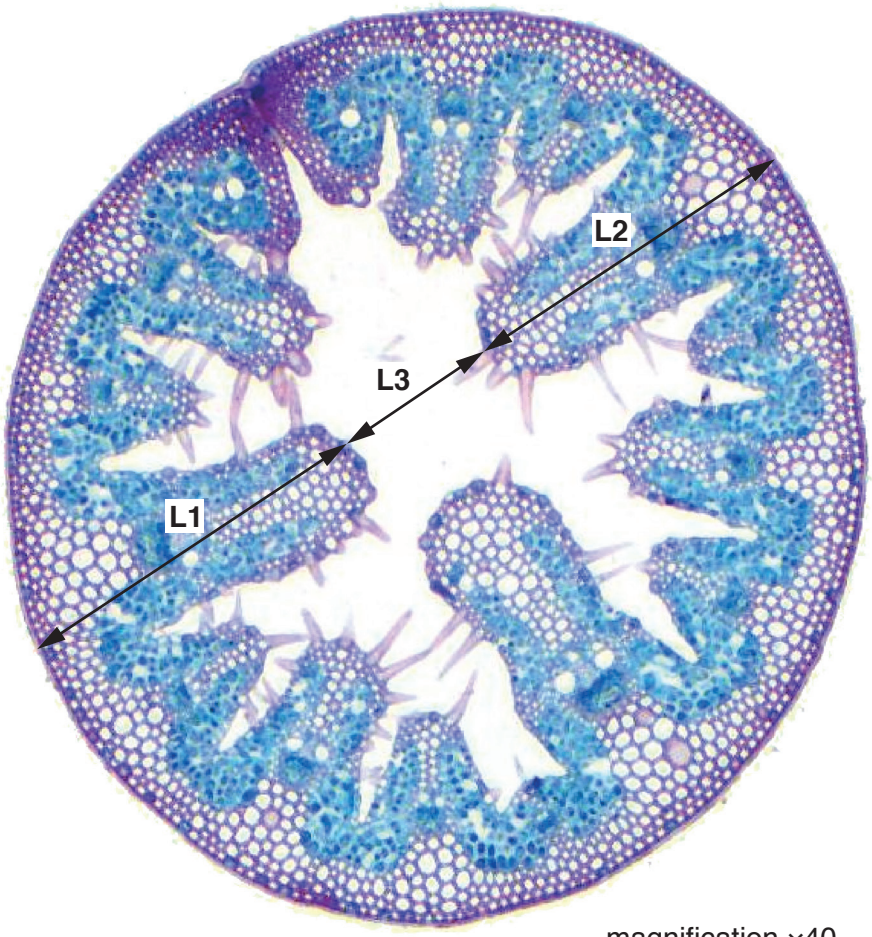
Use **one** ruled label line and label to identify the cell wall of **one** cell.

[5]

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(b) Fig. 2.3 is a photomicrograph of a stained transverse section through a leaf of a different type of plant.

You are not expected to be familiar with this specimen.



magnification ×40

Fig. 2.3

(i) Determine the simplest whole number ratio of the total length of **L1** and **L2** (the leaf tissue) to the length of **L3** (the air space).

Show all the steps in your working.

simplest whole number ratio .....

[4]

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(ii) Observe the leaf on slide **P1** and the leaf shown in Fig. 2.3.

Identify **one** feature to reduce water loss that can be observed for **both** leaves.

Describe how this feature reduces water loss.

feature .....

description .....

.....

[1]

(iii) Observe the leaf on **P1** and the leaf in Fig. 2.3 and identify differences between them.

Record the observable differences in Table 2.1.

Table 2.1

feature	P1	Fig. 2.3

[3]

[Total: 19]

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